This ought not to be. What is to be done, should be done well, and for posterity. We plant our estates to enrich our sons; let us not, at the same time, burden them with the constant repairs of that which should be delivered to them free and unencumbered. You have done much, Mr. Builder, towards the cleansing of the "Augean stable;" you have dealt giant-blows, and progressed with giant strides, yet much remains for you to do. In your efforts to effect so great and good a change we wish you God speed,—remember your motto, and "*nil desperandum.*"

The free seats are very commodious, and fitted up with book and kneeling-boards. The brick floors would be uncomfortable, were not our "bold peasantry, their country's pride," accustomed to that in their own homes, a boarded room being with them a rarity. Bricks and plaster constitute their floors generally. The plaster is very clean and good; it is likewise (an all-important consideration) very cheap.

The reading-desk and pulpit are placed rather curiously, the means of access being through the clerk's desk to the reading-desk, and through both to the pulpit. The pulpit is octagonal, of oak, and is provided with a sounding-board. The windows being behind the desk, the light is thrown directly on the books, without inconveniencing the clergyman.

By referring to the plan it will be seen that this chapel possesses a marked peculiarity, namely, a buttress in the centre of the west end, as Howel Chapel;* Its thickness above the base moulding is 1 ft. 9 in.; its projection 3 ft. 9 in.; it is of three stages, and dies into the wall at about the commencement or base line of gable. With exception of the flue buttress there is only one other, and that is set diagonally at the north-east corner of the chancel; it is finished ere reaching the eares, but the ivy is too thick to ascertain the number of its stages.

I had forgotten to mention an oil painting, (by whom I could not learn) which is hung on the north side of the chancel, but in a light that does not allow it to show to advantage. It is a representation of the birth of our Saviour: astonishment, not unmixed with fear, is depicted in the countenances of the bystanders, who seem to be making all sorts of conjectures, and pointing to the infant Jesus.

W. Wigginton.

REMARKS ON THE RESISTANCE OF POSTS TO FLEXURE.†

The ordinary formula for the stiffness of beams, supported at the ends and loaded in the middle, is

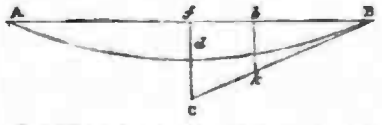
$$w = \frac{b\,d^3}{e\,l^3},$$

in which (w) represents the weight which produces a given deflection; b = breadth in inches; d = depth in inches; and l = length in feet: e is a constant, to be determined by substituting the values of the other quantities in the equation.

In making experiments to determine the constant from this formula, it is necessary to observe very accurately both the weights and the deflections produced by them, and then, by means of a proportion, find the value of (w), which will produce the deflection required to be substituted in the formula.

In reflecting upon the circumstances connected with the flexure of beams, the writer conceived the idea of deducing an expression for the weight which a post would support from the ordinary formula for the stiffness of a horizontal beam, by the following considerations:—If a beam is bent by an applied weight there will be a tendency, from the elasticity of the material, to recover its form when the weight is removed; but if the ends are fastened by being placed between resisting points, so that the piece cannot recover its shape, there must be a horizontal force caused by the reaction of the material, and this force is such, that if the beam were placed in a vertical position and loaded with a weight equal to it, the deflection should be the same as that of the horizontal beam, and consequently the extreme limit of the resistance of the post to flexure would be determined.

To ascertain the force which is exerted by the reaction of a bent beam in the direction of the chord of the arc.



Let AB represent a beam, supported at the ends and loaded with a weight (w) applied at the middle point.

d = deflection caused by the applied weight.

BC = tangent of curve at B.

If the weight be removed, the reaction of the beam will cause it to regain its original figure, if not resisted by a pressure at the ends. The force of this reaction will be proportional to the degree to which the fibres are strained, and as the strain upon the fibres is nothing at the ends A and B, and increases uniformly to the middle point, the force of reaction will be in the same proportion, and the point of application of the resultant of the whole of the reacting forces will correspond to the centre of gravity of a triangle whose base is Bf; it will, consequently, be at a distance from B $= \frac{2}{3}$Bf.

The effect of this resultant acting at a distance $\frac{2}{3}$ Bf, must be the same as the weight $\left(\frac{w}{2}\right)$ acting at a distance Bf, and must consequently be in proportion to $\frac{w}{2}$ as 3 : 4. The value of the resultant is therefore $\frac{3\,w}{4}$.

The line of direction of the pressure at B being the tangent BC, the force of reaction at k may be considered as applied at the point k of its line of direction; and as kAB and CfB are similar triangles, Cf : fB :: $\frac{3}{4}$ w : horizontal pressure at B $= \frac{3}{4}\,w \times \frac{f\,\mathrm{B}}{f\,\mathrm{C}} = \frac{3}{4}\,w \times \frac{\frac{1}{2}\,l}{2\,d} = \frac{3\,w\,l}{16\,d}$. Representing this force by P, we have

$$\mathrm{P} = \frac{3\,w\,l}{16\,d}.$$

As the deflection of a beam within the elastic limits is always in proportion to the weight, if (w') = the weight that will produce a deflection equal to unity, the deflection (d) will require a weight = ($d\,w'$), and by substituting this value in the equation, we find

$$\mathrm{P} = \frac{3}{16} \cdot \frac{d\,w'\,l}{d} = \frac{3}{16}\,w'\,l.$$

In this expression (d), which represents the deflection, has disappeared, and as w' is a constant quantity for the same beam, representing the weight that produces a deflection equal to the unit of measure, it follows that P is the same with every weight and every degree of deflection within the elastic limits.

This result seems at first view to be contrary to fact; it would appear that if the weight be increased, the horizontal strain should be increased in the same proportion; but when it is remembered that the deflection increases with the weight, and that the former diminishes the value of P in precisely the same proportion that the latter increases it, the difficulty vanishes, and the reason why P should be constant for the same beam becomes obvious.

The practical importance of this result is very great, as it furnishes the means of obtaining a formula which will give at once the extreme limit of the resistance to flexure, or the weight which, applied to a post, will cause it to yield by bending.

As the formula used by Tredgold are calulated for a deflection of $\frac{1}{360}$th of an inch to one foot, or $\frac{1}{4320}$ of the length, the weight which would cause a deflection of 1 would be $w\left(1 + \frac{l}{490}\right) = \frac{480\,w}{l}$, and by substituting this value for w' in the equation

$$\mathrm{P} = \frac{3}{16}\,w'\,l,$$

we find P $= 90\,w = \mathrm{A}$.

But from the ordinary formula for the stiffness of a beam supported at the ends we have, $w = \frac{b\,d^3}{e\,l^3}$. Therefore P $= \frac{90\,b\,d^3}{e\,l^3} = \mathrm{B}$.

The expression P $= 90\,w$ shows that the extreme limit of the strength of any post whatever, of any length, breadth, or depth, or of any kind of material, is ninety times the weight which causes a deflection of $\frac{1}{4320}$ of the length.

The second expression, P $= \frac{90\,b\,d^3}{e\,l^3}$, will give the value of P directly, without first knowing the weight required to cause a given deflection in a horizontally supported beam. In this expression, b = breadth in inches, d = depth or at least dimension in inches, l = length in feet, and e = a constant to be determined by experiment for each species of material.

The value of e for white pine is ·01. By substituting this value, we find P $= \frac{9000\,b\,d^3}{l^3}$, a remarkably simple formula, which gives the extreme limit of the resistance to flexure of a white pine post.

The same expression may be used to determine the constants used in the ordinary formula for the stiffness of beams. For this purpose let the equation P $= \frac{90\,b\,d^3}{e\,l^3}$ be transposed, which will give $e = \frac{90\,b\,d^3}{\mathrm{P}\,l^3}$. Find P by applying a string to a flexible strip of the material to be experimented upon, in the manner of a chord to an arc, and ascertain the tension on the chord with an accurate spring balance. It will be found that, whether the strip be bent much or little, the tension on the chord, as shown by the spring balance, will be constant, and this tension, in pounds substituted for P, will give the value of e without requiring, as is necessary with other formulæ, an observation of the deflection.

Experiments made upon these principles with strips of white pine, yellow pine, and white oak, 5 feet long, 1¼ inch wide, and ¼ inch deep, give the following results:—

The observed tensions were—

White pine,	7¼ lbs. value of	e = ·0097
Yellow pine,	6½ ,, ,,	= ·0108
White oak,	6¾ ,, ,,	= ·0104

As the stiffness is inversely as their constants, it follows that white pine is stiffer than yellow pine or oak. The experiments of Tredgold give similar results.

H. Houpt, C.E.

THE WESTMINSTER IMPROVEMENT COMMISSION.

The great importance of forming a thorough fare through the populous district of Westminster, not only for the object of the sanitary condition of a large and densely inhabited district, lying contiguous to the New Palace of Westminster and the Queen's Palace at Pimlico, but also for forming a suitable and convenient communication between the seat of the Legislature and the large and wealthy district of Belgrave-square, has long been recognized. Acts of Parliament were obtained in 1845 and 1847 to promote these objects, and the Legislature, feeling the great importance of the project, granted very considerable powers and pecuniary assistance to the commissioners, to whom the carrying out of the act was intrusted.

Without entering into the details of the various proceedings which are always required to conduct such undertakings to a successful conclusion, or assenting to all the acts of the commissioners, it may be sufficient to say that many improvements have been made in the line of street as originally laid down; and powers to form new collateral streets and other additional advantages have been obtained. The commissioners have silently and gradually purchased a large amount of property through this dense and ill-tenanted locality: nearly the whole line of street is now opened of the *width of 80 feet*, and it is a circumstance unusually favourable in the formation of streets of this description, that a depth of building-land has been secured on each side of the street from 60 to 70 feet deep; and with powers which will be gradually put in force to clear large tracts of the adjoining property. We may have something to say to the commissioners before long.

* See page 169, present vol. of "The Builder."

† From the "Journal of the Franklin Institute."

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